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DIVISION 02 - SITE WORK

SECTION 02600

STONEWORK

03/01

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SECTION 02600

STONEWORK
03/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 88	Test for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.
ASTM C 127	Test Method for Specific Gravity and Absorption of Coarse Aggregate
ASTM C 131	(1989) Resistance to Degradation of Small Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C 136	Method for Sieve Analysis of Fine and Coarse Aggregate
ASTM C 295	Recommended Practice for Petrographic Examination of Aggregates for Concrete
ASTM C 1141	Substitute Ocean Water
ASTM D 3740	(1996) Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
ASTM E 548	(1994) General Criteria Used for Evaluating Laboratory Competence

U.S. ARMY CORPS OF ENGINEERS (USACE)

COE CRD-C 148	(1994) Method of Testing Stone for Expansive Breakdown on Soaking in Ethylene Glycol
COE CRD-C 169	(1997) Standard Test Method for Resistance of Rock to Wetting and Drying

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office, that will review the submittal for the Government: EDG represents the Engineering Division Geotechnical Branch. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Stone Source

Non-listed Quarry Quality Test Data; G

Testing Laboratory; G EDG

Equipment List

Stonework Plan and Schedule; G

Special Procedures; G

Daily Report of Operations

SD-04 Samples

Stone Samples

SD-06 Test Reports

Gradation Tests

Specific Gravity Tests

Rock Test Data

1.3 WORK INCLUDED

The work of this section consists of furnishing all transportation, labor, materials, equipment, and incidentals necessary to construct all project features comprising rock (stone), in whole or in part, in accordance with plans and specifications. Principal rock work items include the following:

1. Cabrillo Shallow Water Habitat Expansion Disposal Site

2. Pier 300 Expansion Disposal Site

3. Southwest Slip Disposal Sites

4. Pier 400 Submerged Material Storage Site

5. Eelgrass Restoration Area

1.4 ARRANGEMENTS, ROYALTIES AND PERMITS

Contractor shall make all arrangements, and secure all permits for the procurement, furnishing and transporting of rock.

1.5 QUALITY ASSURANCE

Contractor shall vary quarrying, processing, loading and placing operations to produce sizes and quality of stone specified. If stone being furnished by Contractor does not fully meet all requirements of these specifications, Contractor shall furnish, at no additional cost to the Government, other stone meeting requirements of these specifications and remove unacceptable rock from the site and dispose in accordance with federal, state and local regulations.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Definitions

Angular Stone. Stone which is obtained from bedrock deposits and is angular in shape.

The words "rock" and "stone" used in this section are interchangeable and shall mean one and the same material.

2.2 SOURCES

Stone shall be furnished from any of the sources listed in paragraph: List of Sources, or at the option of the Contractor may be furnished from any other source proposed by the Contractor and accepted by the Contracting Officer, subject to the conditions herein stated. If the Contractor proposes to furnish stone from a source not currently listed in paragraph: List of Sources, the Government will conduct a quarry investigation and evaluate the Non-listed Quarry Quality Test Data provided by the contractor to determine whether acceptable stone can be produced from the proposed source. Satisfactory service records on other work may be acceptable. In order for stone to be acceptable on the basis of service records, stone of a similar size must have been placed in a similar thickness and exposed to weathering under similar conditions as are anticipated for this contract, and must have satisfactorily withstood such weathering for a minimum of 10 years. If no such records are available, the Government will require the Contractor to conduct tests at the Contractor's expense to assure the acceptability of the stone. In addition to an acceptable 10 year service record, the Contracting Officer has the option to elect to have representative samples taken and tested at the Contractor's expense.

2.2.1 List of Sources

On the basis of information and data available to the Contracting Officer,

stone meeting the quality requirements of these specifications has been produced from the sources listed below:

- Connolly-Pacific's Pebbly Beach Quarry, located near Avalon on Santa Catalina Island
- Corona-Pacific Quarry, located in or near Corona
- 3M Quarry, located in or near Corona
- Hansen-Eagle Valley Quarry, located in or near Corona
- Harlow Quarry, located in or near Corona
- Ortega Quarry, located in San Juan Capistrano
- Twin Oaks North and South Quarries, located near Vista, near Oceanside
- Pyrite Street Quarry, located in Riverside
- Atkinson Quarry, located in Riverside

2.2.2 Selection of Source

The Contractor shall designate in writing the Stone Source or the combination of sources from which the Contractor proposes to furnish stone. It is the Contractor's responsibility to determine that the stone source or combination of sources selected is capable of providing the quality, quantities and gradation needed and at the rate needed to maintain the scheduled progress of the work. Samples for acceptance testing shall be provided in accordance with paragraph QUALITY COMPLIANCE below. If a source for stone so designated by the Contractor is not accepted for use by the Contracting Officer, the Contractor may propose other sources at no additional cost to the Government.

2.2.3 Source Authorization

Before any stone is produced from a source for completion of the work under this contract, the source of stone must be authorized by the Contracting Officer's Representative. Authorization of a stone source shall not be construed as a waiver of the right of the Government to require the Contractor to furnish stone which complies with these specifications.

2.2.4 Acceptance of Materials

Acceptance of a source of stone is not to be construed as acceptance of all material from that source. The right is reserved to reject materials from certain localized areas, zones, strata, or channels, when such materials are unsuitable for stone as determined by the Contracting Officer. The Contracting Officer also reserves the right to reject individual units of produced specified materials in stockpiles at the quarry, all transfer points, and at the project construction site when such materials are determined to be unsuitable. During the course of the work, the stone may be tested by the Government, if the Contracting Officer determines that testing is necessary. If such tests are determined necessary, the testing will be done in a commercial laboratory selected by the Contractor and approved by the Government. Any and all materials produced from a listed or unlisted source shall meet all the requirements herein. The cost of testing will be at the Contractor's expense. During the contract period, both prior to and after materials are delivered to the job site, visual inspections and measurements of the stone materials may be performed by the Contracting Officer. If the Contracting Officer, during the inspections,

finds that the stone quality, gradation or weights of stone being furnished are not as specified or are questionable, re-sampling and re-testing by the Contractor shall be required. Sampling of the delivered stone for testing and the manner in which the testing is to be performed shall be as directed by the Contracting Officer. This additional sampling and testing shall be performed at the Contractor's expense when test results indicate that the materials do not meet specified requirements. When test results indicate that materials meet specified requirements, an equitable adjustment in the contract price will be made for the sampling and testing. Any material rejected shall be removed or disposed of as specified and at the Contractor's expense.

2.3 QUALITY COMPLIANCE TESTING

If the Contractor proposes to furnish stone from an unlisted source, or a listed source which has not been tested in 10 years, the Contractor shall have rocks tests performed on stone samples collected from the proposed source as described in paragraph: STONE QUALITY. Submit suitable Stone Samples 30 days prior to delivery of material to the worksite from any stone source. Contractor shall submit for review by the Contracting Officer Rock Test Data to demonstrate stone materials to be provided for work complies with Specifications. The quarry investigation shall be performed by the Contracting Officer's Representative and an engineering geologist from the Geotechnical Branch of the Los Angeles District. The tests to which the stone shall be subjected include petrographic examination (ASTM C 295), bulk specific gravity (SSD), unit weight, absorption (ASTM C 127), wetting and drying (COE CRD-C 169), Abrasion (L.A. Rattler-ASTM C 131) and sulfate soundness (ASTM C 88).

2.4 STONE QUALITY

The Testing Laboratory to perform the required testing shall be approved based on compliance with ASTM E 548 and relevant paragraphs of ASTM D 3740, and no work requiring testing shall be permitted until the laboratory has been inspected and approved.

2.4.1 Bulk Specific Gravity

All stone shall have a minimum bulk specific gravity, saturated surface dry (SSD) of:

Quarry Run	2.50 (minimum)
Rock Revetment	2.60 (minimum)
Gravel Drainage Blanket	2.50 (minimum)

The method of test for bulk specific gravity (SSD) shall be ASTM C 127.

2.4.2 Unit Weight and Absorption

All stone shall have an absorption less than 2 percent unless other tests and service records show that the stone is satisfactory. The method of test for unit weight and absorption shall be ASTM C 127, except the unit weight shall be calculated in accordance with Note No. 3 below using bulk specific gravity, saturated surface dry.

2.4.3 Petrographic Examination

Stone shall be evaluated in accordance with ASTM C 295. COE CRD-C 148 shall be used to perform Ethylene Glycol tests required on rocks containing smectite and on samples identified to contain swelling clays. See note 5 below.

2.4.4 Wetting and Drying

All stone shall pass the required 15 cycles of wetting and drying in order to be placed on the job. This test does not need to be done if the quarry has been used in the last five years and has a suitable service record. The test must be run on any and all new sources of stone. See COE CRD-C 169. The laboratory shall furnish color photographs of the slab samples prior to and after the wetting and drying tests have been completed. (See Notes 1 and 2 below).

2.4.5 Sulfate Soundness

In accordance with ASTM C 88; 10% maximum loss (see Notes 3 and 4 below).

2.4.6 Abrasion - L.A. Rattler

In accordance with ASTM C 131: 50% maximum loss after 1,000 revolutions. See Note 4 below.

2.4.7 X-Ray Diffraction Analysis

In addition to the above tests, the stone shall be subjected to X-Ray diffraction analysis in accordance with ASTM C 295. The stone must not contain any expansive clays.

2.4.8 Samples

Samples of stone from a proposed source shall be taken at the quarry by the Contracting Officer's Representative, the Superintendent of the quarry, the Contractor and a geologist from the Geotechnical Branch of the Los Angeles District. The samples shall consist of at least 300 pounds(135 Kg.) of stone. The quarry faces and the stockpiles to be used shall be examined and sampled. The Contractor will then ship the samples at the Contractor's expense to a licensed testing Laboratory which has been approved by the Contracting Officer's Representative. The laboratory will be under the direct supervision of a state licensed Civil Engineer, Geotechnical Engineer, Geologist or Engineering Geologist. The results of the tests shall be delivered to the Contracting Officer's Representative as soon as they are received from the laboratory.

2.4.9 Tests

The tests shall be conducted by the Contractor in accordance with applicable ASTM and Corps of Engineers methods of tests shall be performed at a laboratory approved by the Contracting Officer's Representative. All cost of testing shall be borne by the Contractor.

2.4.10 Notes

NOTE: (1) Test Procedures for the Wetting and Drying Test: The entire sample should be large enough to produce two cut slabs, 25 millimeters thick (± 5 millimeters) with a minimum surface area of 20,000 square millimeters on one side. Two chunks approximately 75 by 100 millimeters are also chosen. The slabs and chunks are carefully examined under a low power microscope and all visible surface features are noted and recorded. The specimens are then over dried at 60 degrees Celsius for eight hours, cooled and weighed to the nearest tenth of a gram. The test specimens are photographed to show all surface features before the test. The test specimens are then subjected to fifteen cycles of wetting and drying. One slab and one chunk are soaked in fresh tap water, the other slab and chunk are soaked in salt water prepared in accordance with ASTM C 1141. Each cycle consists of soaking for sixteen hours at room temperature and then drying in an oven for eight hours at 60 degrees Celsius. After each cycle the specimens are examined with the low power microscope to check for opening of movement of fractures, flaking along edges, swelling of clays, softening of rock surfaces, heaving of micaceous minerals, breakdown of matrix material and any other evidence of weakness developing in the rock. The cycle in which any of these actions occur is recorded. After fifteen cycles, the slabs and chunks are again carefully examined and all charges in the rocks are noted and recorded. The test specimens together with all particles broken off during the test are oven dried, weighed and photographed.

NOTE: (2): Weakening and loss of individual surface particles is permissible unless bonding of the surface grains softens and causes general disintegration of the surface material.

NOTE: (3): The test shall be made on 50 particles each weighing 100 Grams, ± 5 grams, in lieu of the gradation given in ASTM C 88.

NOTE: (4): Stone which has a loss greater than the specified limit will be accepted if the Contractor demonstrates that the stone has a satisfactory service record.

NOTE: (5): The test procedure for the Petrographic and X-Ray Diffraction is performed according to ASTM C 295, except for the following:

(a) A colored microscopic photograph shall be made of each stone type (whether igneous, sedimentary or metamorphic) and the individual minerals within the stone type shall be identified by labels and arrows upon the photograph.

(b) A very detailed macroscopic and microscopic description shall be made of the stone, to include the entire mineral constituents, individual sizes, their approximate percentages and mineralogical histories. A description of the stone hardness, texture, weathering and durability factors shall also be discussed.

(c) A written summary of the suitability of the stone for use as stone protection based upon the Petrographic and X-Ray tests and the abrasion

loss (L. A. Rattler) shall be presented in the final laboratory report on stone quality.

2.5 SHAPE

All quarry run and rock revetment shall be angular quarried material (not rounded or subrounded river run) with a shape which assures interlocking with adjacent stone. All rock revetment shall have the greatest dimension not greater than three times the least dimension.

2.6 STONE ACCEPTANCE

Prior to placement, all stone shall be subject to acceptance by the Contracting Officer's Representative. Acceptance of any stone shall not constitute acceptance of all stone from a source. Deliveries which in the judgement of the Contracting Officer do not meet specifications shall be held for testing before their acceptance will be granted. All accepted stone shall be:

a. of the same lithology as the original stone from which test results or service records were taken as a basis for authorization of the source;

b. sound, durable and hard, and free from laminations, weak cleavages,undesirable weathering, or blasting or handling-induced fractures (or fracture zones which subtend more than 1/3 of the total circumference of the stone along the plane of fracturing);

c. of such character that it will not disintegrate from the action of air, water or the conditions of handling and placing;

d. clean and free from earth, clay, refuse, or adherent coatings.

2.7 REJECTED STONE

Stone of unsuitable quality and/or size distribution as required by these specifications will be rejected and shall be promptly removed from the project at no expense to the Government. Any portions of the work covered by these Specifications containing rejected stone will be considered incomplete.

2.8 PERIODIC TESTING

Rock revetment and quarry run taken from a particular source shall be tested and certified in terms of gradation and specific gravity for each 120,000 tons of quarry run, 45,000 tons of rock revetment, and 45,000 tons of gravel drainage blanket material shipped. Submit the Gradation Tests using the GRADATION TEST DATA SHEET for rock revetment, quarry run and graded gravel. Gradation testing shall be in general accordance with ASTM C 136. Specific Gravity Tests shall be in accordance with procedures described in the paragraph: Stone Quality. Testing shall commence prior to shipment of any material and each successive 120,000 tons of quarry run, 45,000 tons of rock revetment, and 45,000 tons of gravel drainage blanket

material delivered, shall be retested in the same manner. Tests shall be performed by an approved testing laboratory on samples selected by the Contracting Officer. The Government reserves the right to perform check tests and to use the Contractor's sampling and testing facilities to make the tests. All sampling and gradation tests performed by the Contractor shall be under the supervision of the Contracting Officer. Upon completion of each test, test results shall be submitted to the Contracting Officer. Additional sampling and testing of any load of material delivered to the project site shall be at the Contracting Officer's discretion, randomly chosen up to a maximum of five tests. Costs for sampling and testing shall be at the Contractor's expense and included in unit prices for rock revetment and quarry run.

2.9 GRADATION

2.9.1 QUARRY RUN

2.9.1.1 Uniform Grading

Each load of quarry run shall have uniform grading from fine to coarse particles to achieve the lines and grades shown on plans. Intent of design is to use well-graded quarry run stone to retain fine-grained dredged materials placed behind dikes. Tests shall be in accordance with ASTM C 136.

2.9.1.2 Fines

Quarry run shall have a minimum of 5 percent and a maximum of 15 percent by weight passing a No. 4 sieve in any one load.

2.9.1.3 Maximum Size

The maximum size of individual pieces of rock shall not exceed 1,500 lb., and 85 to 95 percent shall be less than 400 lb. Material between No. 4 sieve and 400 lb. shall be well graded with a d50 of 5 inches. The d50 defined as the median stone diameter at which 50 percent of material is smaller.

2.9.2 ROCK REVETMENT

Two gradations of rock revetment are required as listed in the following table ROCK GRADATIONS. Rock revetment shall be select, quarried rock which is reasonably well-graded between the minimum and maximum sizes shown on the table.

ROCK REVETMENT GRADATIONS

Designation		A-250	A-500
Nomination		Rock Revetment	Rock Revetment
Side Slope		1.75	1.75 and 1.625
Layer Thickness	[inch]	36	36
Under layer		Quarry Run	Quarry Run
Nominal Size	[lbs.]	250	500

ROCK REVETMENT GRADATIONS

95% of stone larger	[lbs.]	125	200
Maximum Stone Weight	[lbs.]	500	1,000
50% of No. of Stone Weigh more than	[lbs.]	250	500

2.9.3 GRAVEL DRAINAGE BLANKET

The gravel drainage blanket shall be graded within the following limits:

GRAVEL DRAINAGE BLANKET GRADATION

Specified Particle Size (Inches)	Allowable Percentage Smaller By Weight
3.0	100
1.5	0-50
0.25	0-10

2.10 QUARRY OPERATIONS

Quarry operations shall be conducted by the Contractor in a manner that shall produce stone conforming to the requirements specified and may involve selective quarrying, handling, processing, blending, and loading as necessary, all of which shall be as specified in Section 01451A CONTRACTOR QUALITY CONTROL.

PART 3 EXECUTION

3.1 CONSTRUCTION

3.1.1 Equipment List

Contractor shall prepare an Equipment List, listing all major pieces of equipment which are to be used for performing the rock work shall be submitted for Contracting Officer's review. The list shall include, but not be limited to, all vessels, barges, anchors, buoys, and ancillary equipment.

Contractor shall provide for review, sketches of all floating equipment showing access locations and sizes, and the locations and quantities of materials which could be hazardous to the environment or persons in the event of collision or upset.

3.1.2 Stonework Plan and Schedule

Contractor shall submit a Stonework Plan and Schedule which describes the proposed source of stone, equipment, quarry operation, loading/unloading, transportation and placement methods, site access routes, site preparation requirements and sequences planned to be used in rock placement. This plan and schedule shall be provided for review by the Contracting Officer prior to shipment of rock. Schedule shall be updated monthly to reflect work completed and schedule for work yet remaining.

Contractor shall not commence rock work until plan and schedule have been reviewed by the Contracting Officer and incorporated into overall construction and progress schedule.

3.1.3 Special Procedures

Contractor shall develop Special Procedures for the following specific conditions, and submit them to Contracting Officer for review prior to starting work at these locations.

Construction of containment dikes with particular reference to coordination between rock work and dredging. State how each lift of dike shall be raised so that dikes have attained minimum clearance grades before placing dredged material. Scheduling of subsequent rock dike lifts shall be discussed in reference to uninterrupted placement of dredged material.

3.1.4 Daily Report of Operations

The Contractor shall prepare and maintain a Daily Report of Operations and furnish copies thereof to the Contracting Officer. The daily reports shall document all construction related stonework operations for all shifts in a 24-hour period.

3.2 PLACEMENT

3.2.1 General

Except as otherwise specified, the limits of the stone in place shall follow the indicated lines and slopes without continuous under or over building. Templates shall be placed at adequate intervals, as determined by the Contracting Officer, to accurately delineate the surfaces of the dike. **Rock placement by bottom dump method is not allowed.** The stone work shall be finished smooth to a surface even with the existing work. For all stone work, the Contractor shall submit the method of placement to the Contracting Officer for approval before commencement of placing operations.

3.2.2 Coordination with Dredging

Stone work and dredging must be fully coordinated to achieve project design criteria and purpose while adhering to requirements specified in Section 01355 ENVIRONMENTAL PROTECTION. Requirements for approval of the Contractor's Stone Work Plan are specified in paragraph 1.2, SUBMITTALS. Contractor shall select excavation, placement and earthwork methods, and construction schedule, appropriate to achieve lines and grades shown on Plans. See Section 02020 DREDGING and Section 02373 GEOTEXTILE. For stone work which involves construction of containment dikes for dredged material, Contractor shall exercise care to avoid placing dredging material to elevations above the top of dikes such that dredge material can be lost over or through the dikes.

3.2.3 Construction Load on Containment Dike

Contractor shall exercise extreme care if heavy construction loads are placed near edge of dike. Contractor shall repair any damage caused by his

activities.

3.2.4 Tolerances

Rock work shall be carried to the lines and grades shown on Plans, and tolerances as specified in this Section, and as directed by the Contracting Officer. Final surface of each finished course shall follow with reasonable variation the indicated lines and grades without continuous under or overbuilding. Deviations in layer thickness, and position and elevation of final surfaces shall be no greater than the values given in Table ALLOWABLE TOLERANCES FOR STONE CONSTRUCTION WITH RESPECT TO NEAT LINES. Listed tolerances on slopes are measured normal to the design slope with respect to indicated neat lines. Either extreme of the tolerances listed in the table shall not be continuous over an area greater than 200 square feet. The Contracting Officer may change lines and grades shown on Plans. If changes increase or decrease the quantity of rock to be placed, revised quantities shall be used as basis of payment under unit price for rock work involved.

ALLOWABLE TOLERANCES FOR STONE CONSTRUCTION WITH RESPECT TO NEAT LINES
(Dimensions in Feet Measured Normal to Surface)

Designation	Layer(2) Thickness (feet)		Final Exposed Sloped Surfaces				Final Exposed Horizontal Surfaces (Crest and Berm Elev.)			
			Below 0.0 MLLW		Above 0.0 MLLW		Below 0.0 MLLW		Above 0.0 MLLW	
	(-)	(+)	(-)	(+)	(-)	(+)	(-)	(+)	(-)	(+)
Quarry Run(1)	1.0	1.0	1.0	1.0	0.5	0.5	1.0	1.0	0.5	0.5
A-500	1.0	1.5	1.0	1.5	1.0	1.0	N.A.	N.A.	0.5	0.5
A-250	0.5	0.5	0.5	0.5	0.5	0.5	N.A.	N.A	0.5	0.5

(1) Layer thickness for quarry run refers to places where quarry run is used as bedding or underlayer for larger destination stone.

(2) Cumulative layer thicknesses should not exceed the tolerances for the final exposed surfaces.

3.2.5 Misplaced Material

Any material that escapes or is lost at any time while loading, transporting or placing rock, or which is deposited other than in area designated on the plans, or change approved in writing by Contracting Officer, shall be removed and redeposited where directed by the Contracting Officer, at Contractor's expense.

3.2.6 Misplaced Equipment

Should Contractor (during progress of work) lose, dump, throw overboard, sink, or misplace any material, plant, machinery or appliance that may be dangerous to, or interfere with uses of waterway, or cause pollution of waters, Contractor shall give immediate notice to Contracting Officer, with description and location of such obstructions until they are removed. Should Contractor refuse, neglect or delay compliance with above requirements, such obstructions may be removed by the City, and cost of

such removal may be deducted from any money due or to become due to Contractor.

3.2.7 Maintenance of Quarry Run Slopes

Portions of the quarry run dikes require rock revetment for stability. Exposed quarry run surfaces are vulnerable to damage until all quarry run lifts have been placed, rock revetment is in place and stone work has been accepted. Contractor shall be responsible for care and maintenance of quarry run slopes until final acceptance by Contracting Officer. Damage to quarry slopes due to any cause prior to acceptance shall be repaired, at Contractor's expense.

3.2.8 Displaced Material

Any cut slope which is displaced by the stone placement operation and is outside the lines and grades shown on the plans, shall be removed and the area restored to its design cross section, at Contractor's expense.

3.3 ROCK REVETMENT PLACEMENT

3.3.1 Placement

The rock revetment shall be placed so that a reasonably well graded mass is produced with a minimum practicable percentage of voids. Rock revetment layers shall be constructed to lines and grades indicated on Plans. Rock revetment shall be placed to its full course thickness in one operation and in a manner which will avoid displacing underlying quarry run or underlayer stone. Stone shall be allowed to fall no more than 3 feet from bottom of clam or other bucket and top surface of stone work for work within 3 feet of water level. For underwater work, where work surface is more than 5 feet below water level, maximum drop shall be 5 feet. Not withstanding, an otherwise allowable height using Contractor's approved placement method will not be permitted if it is shown to cause segregation of stone sizes, or breakage of individual stones. In those cases, allowable drop heights will be developed on-site, between Contracting Officer and Contractor, based on actual performance. Contractor shall maintain rock revetment layer until accepted and any material displaced, or with damage to surface by any cause, shall be replaced to indicated lines and grades, at Contractor's expense. Self propelled equipment shall not be used on slopes. Placing rock revetment by dumping into chutes or similar methods will not be permitted.

3.3.2 Excavation

Excavation of sediments may be required during placement of the rock revetment. Excavation shall be conducted to remove the accumulated materials from the existing dike surface in order to properly achieve the interlocking of rock revetment. The excavated materials shall be deposited in the area shown on the plans. Objectionable materials and debris from the excavated materials shall be removed, become the property of the Contractor, and disposed of in a suitable location. Excavation of sediments, as necessary for interlocking of the rock revetment, will be considered as part of the work to place new stone.

3.4 QUARRY RUN

3.4.1 General

Quarry run stone shall be placed by any method desired by Contractor subject to limitations given below and with review and approval by Contracting Officer.

3.4.2 Unprotected Slopes

Quarry run shall be placed on slopes of underlying surfaces where required on Plans as soon as possible after dredging, so that slopes do not deteriorate before quarry run material has been placed.

3.4.3 Handling

Quarry run materials shall be placed uniformly on bottom, to neat lines indicated on plans. Placing quarry run material by methods which would tend to cause segregation by particle sizes will not be permitted.

3.4.4 Minimum Lift

Dike lifts shall be greater than 4 feet in thickness. The lift above shall be extended down to meet existing bathymetry when thickness of lower lift is less than 4 feet.

3.5 ROCK PLACEMENT AREAS

3.5.1 Rock Placement At Southwest Slip Area 1

3.5.1.1 Purpose

Construct containment dike in the Southwest Slip Area 1 to contain dredged material, form the perimeter of the Confined Disposal Facility, and the revetment for the LACFCD Channel.

3.5.1.2 Extent and Location of Work

Perimeter of Southwest Slip Area 1 fill containment dikes as indicated on the plans.

3.5.1.3 Materials

Quarry run rock, rock revetment, and gravel drainage blanket.

3.5.1.4 Sequence of Work

Dike shall be placed after dredging required for dike, placement of gravel drainage blanket and placement of dike wick drains. Revetment for the LACFCD Channel shall be placed after the dredging and excavation required for the channel. The placement level of the dike shall be above the placement level of the sand berm, dredge element D201 and D205, fine grain fill and surface cover layer. Effective confinement of dredged material

shall be maintained at all times.

3.5.2 Rock Placement at Southwest Slip Area 2

3.5.2.1 Purpose

Construct containment dike in the Southwest Slip Area 2 to contain dredged material.

3.5.2.2 Extent and Location of Work

Perimeter of Southwest Slip Area 2 fill containment dikes as indicated on the plans.

3.5.2.3 Materials

Quarry run rock, Rock Revetment, and gravel drainage blanket.

3.5.2.4 Sequence of Work

After dredging required for dike, placement of gravel drainage blanket and placement of dike wick drains. The placement level of the dike shall be above the placement level of the sand berm and fill. Effective confinement of dredged material shall be maintained at all times.

3.5.3 Rock Placement At Southwest Slip Area 3

3.5.3.1 Purpose

Construct containment dike in the Southwest Slip Area 3 to contain dredged material.

3.5.3.2 Extent and Location of Work

Perimeter of Southwest Slip Area 3 fill containment dikes as indicated on the plans.

3.5.3.3 Materials

Quarry run rock, Rock Revetment, and gravel drainage blanket.

3.5.3.4 Sequence of Work

After dredging required for dike, sequentially place the gravel drainage blanket, then dike wick drains, and then quarry run.

3.5.4 Rock Placement At Pier 300 Expansion

3.5.4.1 Purpose

Construct containment dike for the Pier 300 Extension to contain dredged material.

3.5.4.2 Extent and Location of Work

Perimeter of Pier 300 Extension fill containment dikes as indicated on the plans.

3.5.4.3 Materials

Quarry run rock and Rock Revetment.

3.5.4.4 Sequence of Work

After dredging required for dike. The placement level of the dike shall be above the placement level of the fill. Effective confinement of dredged material shall be maintained at all times.

3.5.5 Rock Placement At Cabrillo Shallow Water Habitat Expansion

3.5.5.1 Purpose

Construct containment dike for the Cabrillo Shallow Water Habitat Expansion to contain dredged material.

3.5.5.2 Extent and Location of Work

Perimeter of Cabrillo Shallow Water Habitat Expansion fill containment dikes as indicated on the plans.

3.5.5.3 Materials

Quarry run rock.

3.5.5.4 Sequence of Work.

The placement level of the dike shall be above the placement level of the fill and surface cover layer. Effective confinement of dredged material shall be maintained at all times.

3.5.6 Rock Placement At The Pier 400 Submerged Material Storage Site

3.5.6.1 Purpose

Construct containment dike for the Pier 400 Submerged Material Storage Site to contain dredged material and surcharge materials.

3.5.6.2 Extent and Location of Work

Perimeter of Pier 400 Submerged Material Storage Site fill containment dikes as indicated on the plans. Toe of rock dike shall be a minimum of 500 feet from the TITP sewer outfall.

3.5.6.3 Materials.

Quarry run rock.

3.5.6.4 Sequence of Work

The placement level of the dike shall be above the placement level of the fill and surface cover layer. Effective confinement of dredged material shall be maintained at all times.

3.5.7 Rock Placement At The Eel Grass Restoration Area

3.5.7.1 Purpose

Construct containment dike for the Eel Grass Restoration Area to contain dredged material.

3.5.7.2 Extent and Location of Work

Perimeter of Eel Grass Restoration Area containment dikes as indicated on the plans.

3.5.7.3 Materials

Quarry run rock.

3.5.7.4 Sequence of Work

The placement level of the dike shall be above the placement level of the fill. Effective confinement of dredged material shall be maintained at all times.

3.6 SURVEYS

Surveys will be conducted by Contractor and Contracting Officer before and after placing stone. Surveys of previous fill sections shall be the basis of proceeding to the subsequent rock element. Surveyed segments will be taken from multi-beam surveys looking down the slope while moving parallel to the face of the rock, and the above water surveys will be collected on 50-foot cross-sections, or denser in irregular, areas with an accuracy of one foot horizontally and 0.2 feet vertically. Cross-sections will be cut through the digital terrain model (DTM) of the surface created by the multi-beam and above water surveys. Cross-section spacings will be adjusted to fit the conditions at the time, and used for analysis only. Delta surfaces (the difference between the planned DTM surface and the measured DTM surface - usually contoured) will be used to determine rock placed out of tolerance. Each section will define sufficient points to accurately represent stone in place, binning of data (average of data in a mathematical grid given the coordinates of the center of the grid) will be used to create the DTM. The bin size (the length of each side of the grid cell) will be 3.28 feet by 3.28 feet or as determined by the Contracting Officer. Deductions to measured quantity of stone will be made for stone occurring outside tolerances. Deductions will be from disallowed delta area surface plots and converted to tonnage using surface subtraction and a value of thirty percent (30%) voids for placed stone and bulk Specific Gravity as determined by paragraphs: STONE QUALITY and PERIODIC TESTING.

-- End of Section --